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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/293,188 | 04/16/1999 | ZHIPING YIN | 11675.165.1 | 4546 |

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| EXAMINER | |
|---|---|
| CAO, PHAT X | |
| ART UNIT | PAPER NUMBER |
| 2814 | |

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|---|---|---|
| 3 MONTHS | 04/16/2007 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/293,188 | YIN ET AL. | |
| | Examiner | Art Unit | |
| | Phat X. Cao | 2814 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *25 January 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *31-38 and 40-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *34,35,49 and 50* is/are allowed.

6)☒ Claim(s) *31-33,40 and 45* is/are rejected.

7)☒ Claim(s) *36-38,41-44 and 46-48* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/25/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

1. The cancellation of claims 1-30 and 39 in Paper filed on 1/25/07 is acknowledged.

### *Claim Objections*

2. Claim 34 is objected to because of the following informalities: In claim 34, line 11, "a chemical the chemical composition..." should be changed to "the chemical composition ...". Appropriate correction is required.

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

4. Claims 31, 33, 40, and 45 are rejected under 35 U.S.C. 102(e) as being anticipated by Hong et al (US. 6,077,774).

Regarding claims 31 and 33, Hong (Figs. 1A-1F) discloses a method of reducing oxidation of an electrically conductive material, comprising: forming a first dielectric layer 12 on a semiconductor structure 10 (column 2, 57-61), the first dielectric layer 12 comprising a depression 16 therein; filling the depression with an unutilized electrically conductive material 30; a chemical composition precursor gas (column 4, lines 57-62) introduced to a surface of the electrically conductive material 30 and reacting with the metal atoms on an upper surface of the electrically conductive material 30 (see abstract, last 7 lines) to form a chemical compound layer 32/34 (see Figs. 1E-1F) of metallic carbide (i.e., TiC or CrC) (column 5, lines 19-21), which has more resistant to oxidation than the electrical conductive material 30 of copper; and forming a second dielectric layer 36 over the electrically conductive material 30 and the first dielectric layer 12 and adhering the second dielectric layer 36 to the electrically conductive material, wherein the reacting the chemical composition to form the chemical compound layer 32/34 is simultaneously occurred during the deposition of the second dielectric layer 36 (column 5, lines 9-14).

Regarding claims 40 and 45, Hong (Figs. 1A-1F) discloses a method of reducing oxidation of an electrically conductive material, comprising: forming a first dielectric layer 12 on a semiconductor structure 10 (column 2, 57-61), the first dielectric layer 12 comprising a depression 16 therein; filling the depression with an unutilized electrically conductive material 30; a chemical composition precursor gas (column 4, lines 57-62) absorbed to a surface of the electrically conductive material 30 and reacting with the metal atoms on an upper surface of the electrically conductive material 30 (see abstract,

last 7 lines) to form a passivate chemical compound layer 32/34 (see Figs. 1E-1F) of metallic carbide (i.e., TiC or CrC) (column 5, lines 19-21), which has more resistant to oxidation than the electrical conductive material 30 of copper; and forming a second dielectric layer 36 over the electrically conductive material 30 and the first dielectric layer 12 and adhering the second dielectric layer 36 to the electrically conductive material such that the passivation layer 32/34 is substantially absorbed by the second dielectric layer 36 by reacting with carbon in the second dielectric layer 36 (column 5, lines 9-14).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong et al (US. 6,077,774) in view of Sekiguchi et al (US. 5,780,908).

Hong does not disclose that the electrically conductive material 30 comprises a refractory metal.

However, Sekiguchi (Fig. 3e) teaches the forming of an electrically conductive material 7 within a depression of a dielectric layer 4, the electrically conductive material 7 is made of tungsten refractory metal (column 12, lines 21-23). Accordingly, it would have been obvious to use tungsten refractory metal as the material for the electrically conductive material 30 of Hong because tungsten is well known and commonly used as

a buried plug because it has good conductivity characteristics and it does not harmfully effect the device, as taught by Sekiguchi (column 5, lines 53-58).

**Allowable Subject Matter**

7. Claims 34-35 and 49-50 are allowed (see reasons of record).

8. Claims 36-38, 41-44, and 46-48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art of record neither anticipates nor renders obvious all the limitations recited in the claims above, including the limitation of having a nitrogen composition as the composition of the chemical compound for reacting with the surface of the electrically conductive material.

***Response to Arguments***

9. Because of the new issues presented in the amended claims, the new ground of rejection is applied.

***Conclusion***

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is 571-272-1703. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PC
April 9, 2007

PHAT X. CAO
PRIMARY EXAMINER